MASTER

XXXII

Year-to-year variations in monthly mean temperatures

1. Introduction

The mean temperature for a given month is found by taking the average daily maximum temperature experienced during the month, the average daily minimum temperature, adding them together and dividing by two.

The average monthly temperature is the average of such means taken over a series of years, (usually 30).

It is often desired to know by how much a month in any one year is likely to deviate from such an average. Following the example of Agricultural Memorandum No.31, in which variations of rainfall were discussed, the simplest way to do this without resort to statistical theory is to present 10 sample deviations from average. These range from the greatest positive deviation to the greatest negative deviation likely to be experienced in a decade.

2. Stations Used

12 stations with reliable temperature records over the period 1906-1955 were used; namely:-

Station	Annual Average Temperature (1906-1955)	Location
Durham	47.4	North: Inland
Manchester	49.6	North: Inland
Spurn Head	49.1	North: Coastal
Bidston	49.1	North: Coastal
Cromer	49.5	North: Coastal
Coventry	49.1	North: Inland
Woburn	48.6	South: Inland
Bath	50.3	South: Inland
Plymouth	51.5	South: Coastal
Newquay	51.0	South: Coastal
Kew	50.5	South: Inland
Eastbourne	50.8	South: Coastal

Six stations were thus in the northern half of England, and six in the southern half; in each group there were 3 coastal and 3 inland stations.

Method of use

For each station and each month, 50-year averages were found. The deviations from average were then arranged in algebraic numerical order and the mean of successive groups of 5 deviations were computed. This gave 10 sample deviations for each month and each station, these samples for each month were then averaged over the 12 stations, or over the sub-groups of 6, as required.

Results

Table I gives the sample deviations, month by month, taking the average samples of all 12 stations.

The largest deviations from average are clearly to be expected in the winter months, especially in regard to negative deviations in February. The monthly mean temperatures in May and June vary least from the long-term average. A slight skewness in variation is noted in most months.

Table II gives the sample deviations, in pairs of months for (a) stations in north or south of the country and (b) stations on the coast or inland.

The north tends to have the larger variations in spring and early summer, the south in early winter. There is little difference apparent in the other seasons of the year.

As might be expected, inland stations always show a greater tendency to large variations from average, but the differencies are not as great as might have been expected.

Extremes

To complete the record the extreme monthly mean variations recorded at the stations during the 50 years under review are summerized in Table III. This shows, for each month, the extreme deviations (warmest and coldest)averaged for each of the sub-groups, north, south, inland and coastal. It gives the largest extremes, quoting the station and year.

In the warmest months (Table IIIa), the north shows the greater deviation during March, May, June and October, but is less than the south in November, the other differencies being small. The inland stations are consistently liable to greater departures from average except in June.

In the coldest months (Table III(b), the north is more variable in July and November, the south in February, May, June, October and December. Inland stations are consistently more variable except in April.

With regard to the absolute extremes, these cannot be regarded as "records" because only 12 stations were considered. The range from lowest to highest, irrespective of station or year, varies considerably according to season:-

January	18.1	May	10.3	September	11.5
February	18.5	June	10.2	October	11.8
March	13.5	July	10.8	November	13.2
April	11.4	August	12.4	December	14.4

It is interesting to note that of the warmest extremes, nine have occurred in the second 25 years of the period, and only 3 during the earlier years. In fact, nearly half of these extremes occurred in the eight years between 1938 and 1945. Of the coldest extremes, the reverse is true, the division being $7\frac{1}{2}$-$4\frac{1}{2}$ in favour of the first half of the period, almost all occuring between 1916 and 1919.

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Table I

Mean Deviations from Temperature Average (°F) in a sample of ten years

	1	2	3	4	5	6	7	8	9	10
January	-5.8	-2.8	-1.6	-0.8	-0.1	+0.6	+1.3	+2.0	+2.8	+4.5
February	-6.6	-3.1	-1.8	-0.9	-0.1	+0.8	+1.7	+2.4	+3.2	+4.4
March	-4.0	-2.7	-1.7	-1.1	-0.5	+0.3	+1.0	+1.7	+2.7	+4.3
April	-3.6	-2.2	-1.5	-0.8	-0.3	+0.1	+0.8	+1.4	+2.4	+3.7
May	-3.0	-1.9	-1.2	-0.7	-0.3	+0.3	+0.7	+1.2	+2.0	+2.9
June	-3.3	-1.8	-1.0	-0.5	-0.1	+0.3	+0.6	+1.0	+1.7	+3.0
July	-3.5	-2.2	-1.4	-0.8	-0.3	+0.2	+0.7	+1.4	+2.3	+3.7
August	-3.6	-2.0	-1.2	-0.7	-0.3	+0.2	+0.7	+1.2	+2.0	+3.8
September	-3.5	-2.0	-1.4	-0.7	-0.2	+0.3	+0.8	+1.3	+1.8	+3.6
October	-3.6	-2.0	-1.2	-0.7	-0.1	+0.3	+0.8	+1.1	+1.9	+3.7
November	-5.0	-2.5	-1.2	-0.5	0.0	+0.5	+0.9	+1.6	+2.5	+3.7
December	-4.8	-3.0	-2.1	-1.2	-0.2	+0.7	+1.4	+2.0	+2.9	+4.3

Table II

Sample deviations from temperature average for stations

(a) North and South, and (b) Coastal and Inland

		1	2	3	4	5	6	7	8	9	10
Spring March-April	N	-4.0	-2.7	-1.6	-0.9	-0.4	+0.2	+0.9	+1.7	+2.6	+4.2
	S	-3.6	-2.3	-1.6	-1.0	-0.4	+0.3	+0.9	+1.5	+2.4	+3.8
	Coastal	-3.7	-2.3	-1.5	-0.9	-0.4	+0.2	+0.8	+1.5	+2.4	+3.8
	Inland	-4.0	-2.6	-1.7	-1.0	-0.5	+0.3	+1.0	+1.7	+2.7	+4.2
Early Summer May-June	N	-3.3	-1.9	-1.2	-0.6	-0.2	+0.2	+0.6	+1.1	+1.9	+3.2
	S	-3.0	-1.8	-1.1	-0.6	-0.2	+0.3	+0.7	+1.2	+1.8	+2.8
	Coastal	-2.9	-1.6	-1.1	-0.6	-0.2	+0.2	+0.6	+1.0	+1.7	+2.7
	Inland	-3.4	-2.0	-1.2	-0.7	-0.2	+0.3	+0.7	+1.2	+2.0	+3.2
Mid-Summer July-August	N	-3.7	-2.2	-1.3	-0.7	-0.2	+0.2	+0.7	+1.4	+2.2	+3.6
	S	-3.4	-2.1	-1.3	-0.7	-0.3	+0.1	+0.6	+1.2	+2.2	+3.9
	Coastal	-3.4	-2.0	-1.1	-0.6	-0.2	+0.1	+0.6	+1.2	+2.0	+3.4
	Inland	-3.7	-2.3	-1.4	-0.8	-0.4	+0.2	+0.7	+1.4	+2.4	+4.1
Autumn September-October	N	-3.6	-2.0	-1.3	-0.7	-0.1	+0.4	+0.8	+1.2	+1.8	+3.6
	S	-3.6	-2.0	-1.3	-0.7	-0.2	+0.3	+0.8	+1.2	+1.8	+3.6
	Coastal	-3.4	-2.0	-1.2	-0.6	-0.1	+0.3	+0.8	+1.1	+1.7	+3.5
	Inland	-3.7	-2.1	-1.4	-0.7	-0.2	+0.3	+0.8	+1.3	+1.9	+3.7
Early Winter November-December	N	-4.7	-2.6	-1.6	-0.7	-0.1	+0.5	+1.1	+1.7	+2.6	+3.8
	S	-5.2	-2.9	-1.8	-1.0	-0.1	+0.7	+1.3	+2.0	+2.8	+4.2
	Coastal	-4.6	-2.5	-1.5	-0.9	-0.1	+0.6	+1.1	+1.8	+2.5	+3.7
	Inland	-5.3	-3.0	-1.8	-0.9	-0.1	+0.6	+1.2	+1.9	+2.9	+4.3
Late Winter January-February	N	-6.1	-3.0	-1.6	-0.8	-0.1	+0.6	+1.4	+2.0	+2.9	+4.5
	S	-6.4	-3.0	-1.8	-1.0	-0.1	+0.7	+1.6	+2.4	+3.2	+4.5
	Coastal	-5.8	-2.8	-1.6	-0.8	-0.1	+0.6	+1.3	+2.0	+2.8	+4.2
	Inland	-6.6	-3.2	-1.8	-0.9	-0.1	+0.8	+1.6	+2.4	+3.2	+4.8

Table III(a)

Extremes of monthly temperatures (maximum) (1906-1955)

Month	Mean of Stations				Extreme		
	North	South	Coastal	Inland	Deviation	Station	Year
January	+6.3	+6.0	+5.5	+6.8	+7.2	Coventry	1916
February	+5.3	+5.2	+4.9	+5.6	+6.4	Cromer	1945
March	+6.7	+5.4	+5.7	+6.4	+8.2	Durham	1938
April	+4.6	+4.5	+4.4	+4.7	+5.6	Cromer	1943
May	+4.0	+3.0	+3.1	+3.8	+4.6	Durham	1952
June	+4.4	+4.0	+4.2	+4.3	+5.2	Durham	1940
July	+4.4	+4.3	+4.2	+4.5	+5.4	Coventry	1911
August	+5.0	+5.1	+4.7	+5.4	+6.9	Manchester	1947
September	+5.4	+5.5	+5.2	+5.7	+6.2	Woburn	1949
October	+5.4	+5.0	+4.8	+5.5	+5.9	Woburn	1921
November	+4.3	+4.8	+4.0	+5.1	+5.7	Bath	1938
December	+5.4	+5.8	+5.2	+6.0	+6.6	Bath	1934

Table III(b)

Extremes of monthly temperatures (minimum) (1906-1955)

Month	Mean of Stations				Extreme		
	North	South	Coastal	Inland	Deviation	Station	Year
January	-8.2	-8.2	-7.0	-9.4	-10.9	Woburn	1940
February	-9.9	-10.3	-9.8	-10.5	-12.1	Coventry	1947
March	-4.8	-4.8	-4.8	-4.9	-5.3	Durham Cromer	1947 1917
April	-5.1	-4.9	-5.2	-4.9	-5.8	Cromer	1917
May	-4.0	-4.6	-3.7	-4.9	-5.7	Bath	1941
June	-4.0	-4.3	-4.0	-4.4	-5.0	Kew	1916
July	-4.7	-4.2	-4.4	-4.5	-5.4	Cromer	1919
August	-5.0	-4.9	-4.8	-5.0	-5.5	Plymouth	1912
September	-4.3	-4.5	-4.4	-4.4	-5.3	Woburn	1912
October	-4.4	-4.8	-4.4	-4.9	-5.9	Kew	1919
November	-6.2	-5.9	-6.0	-6.1	-7.5	Cromer	1919
December	-5.9	-7.0	-6.4	-6.5	-7.8	Eastbourne	1933

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